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A PROPOSAL TO IMPROVE COMMUNITY DESIGN FOR ENERGY BOOMTOWNS

SUBMITTED TO

MONTANA COAL BOARD
CAPITOL STATION
HELENA, MONTANA 59601

The Montana Energy and MHD Research and Development Institute, Inc.

Post Office Box 3809
Butte, Montana 59701

JUNE 6, 1980

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TOWARD IMPROVED COMMUNITY DESIGN FOR ENERGY BOOM TOWNS

1.0 INTRODUCTION

The western United States has abundant natural energy resources which will be increasingly cultivated in the near future. The development and utilization of these resources will necessitate the formation of new communities or the growth of present communities near the resource. Rapidly growing energy communities have been described as undesirable places in which to live, and also have been plagued with excessive costs for construction, energy use, and maintenance. The developers who build these communities, for the most part, do not make investments in features necessary to improve the satisfaction of community residents.[1] Further, these same developers engage in practices which increase the cost of development energy use and maintenance costs.

The character of rapidly growing ("boomtown") communities tends to be determined more by the activities of developers during the first five years after development than by any other group. This remains true regardless of the strength or weakness of local planning programs. Developers generally are free to meet minimum standards set by code or, under special circumstances, greatly exceed them. Public planners, on the other hand, exert a relatively minor influence within the bounds of a political and legal system.

Most developers are small and cannot hire the sophisticated planning expertise necessary to design and build complete high quality communities.

Lacking in resources and knowledge to build such communities, they fall back on standard development techniques which, while they do meet code, do not yield high quality developments.

The investment in certain kinds of amenities, energy and environmental improvements, and land use patterns can actually lower the cost to developers, consumers, and municipalities. Further, long-term residential satisfaction can be higher. Making this information available to more developers is an important step toward improving energy boomtown development, and must be well documented and credible.

The developer is in business to make money. He knows his market and that the product he is building will sell, he will change practice only on strong evidence that a different practice will improve his return and that it will sell. However, the developer can choose only from among practices of which he is aware and which are understood well enough to predict costs with a degree of certainty.

Extensive social costs attributable to land development have been accepted in energy boomtowns. These costs are born by residents with little satisfaction in their surroundings, social service agencies with excessive client loads, local taxpayers with high property taxes from maintaining unsound land use patterns, and the United States as a whole with energy impact assistance.[2] An additional burden of high energy costs to residents derives from inefficient housing unit siting and land use patterns.[3]

There has been a substantial amount of research done on methods to improve development, but little of it is geared toward the needs of developers who base their investment decisions on either minimum code requirements or return on investment. Land development has typically yielded returns on investment which are high enough that, in spite of poor planning and management, profits are still high. This has not encouraged smaller developers to seek assistance in improving the quality of community design.

By evaluating boomtown communities to determine which factors lead to the greatest resident satisfaction, overbuilding or inappropriate building of facilities can be reduced, thus permitting resources to be concentrated on the most important needs. A further expected benefit is that travel to escape the unpleasant local area would be reduced because the local environment will be more attractive. It is possible that, with a conducive environment, primary social linkages will form more quickly, leading to a lower level of alienation and its incumbent problems (crime, divorce, etc.).

Two questions need answers to enable informed decisions on the degree of quality to be built into new communities:

1) From the developer's perspective, does the market exist for quality design--market in the narrow sense which considers only developers and buyers? If so, developers must become aware of this.

2) From the local, state, and federal governmental perspective, will quality design pay for itself (lower crime rates, more stable labor force, etc.)? If so, then mechanisms to motivate the developer to do what is in society's best interest are needed.

Development regulations simply do not provide the incentive or information necessary to implement sound boomtown growth policies. The provision of better information to public planners provides only limited improvement in the quality of development. Information must be provided to developers on the costs and benefits of alternative development policies. Larger developers can afford to buy the planning expertise necessary to develop this information, while smaller developers cannot.

MERDI proposes to provide information which developers can base sound management decisions about whether to invest in conventional or alternative development. By internalizing these costs and benefits the developer can maximize his return, produce a higher quality development, and reduce the economic burden on the community.

2.0 OBJECTIVES

This project is designed to provide detailed cost comparisons and consumer satisfaction information to developers for determining those development practices that are in their best interests. This information will be presented in a form which meets developer's needs; further, it will be based on sound data obtained from cost models which developers can apply to their own situation. Moreover, since feasibility is limited by the market, consumer satisfaction is critical.

The following objectives of the project are:

1. To demonstrate cost and benefits to communities, developers, and consumers from investing in amenities, energy conservation, and sound land use;

2. To assemble developer packages giving management information on which sound investment decisions can be based and demonstrating how to implement these decisions;

3. To define those factors which have contributed to the success or failure of boom towns in meeting the needs of their residents, local governments, and developers in terms of costs of development, and maintenance, and degree of satisfaction; and

4. To disseminate the information to developers and local planners.

MERDI proposes to accomplish these objectives through a two-phase project. Phase I is the development of the information packages. Phase II is a training program for developers.

3.0 SCOPE OF WORK

This proposal is limited to Phase I with Phase II contingent on future funding. Phase I consists of the four main tasks:

1. A survey of two energy boom towns conducted to determine their apparent success or failure at meeting resident needs;

2. A design model developed from state-of-the-art practices for cost effectiveness, energy efficiency, and factors derived from the Task 1 survey;

3. Cost comparisons between the elements of the design model and conventional development techniques; and

4. User packages assembled from this information consisting of manuals and training scripts.

Each of these tasks is broken into subtasks as the following describes.

3.1 Community Selection and Assessment

Two energy boom towns will be selected for their high or low quality of life as indicated by published social statistics, such as census data, the Uniform Crime Report, and state vital statistics. These then will be surveyed to determine which factors of the built environment have contributed to or detracted from resident satisfaction.

3.1.1 Selection of Survey Communities

Two boom communities will be selected for their apparent success or failure as defined by published social problems data such as crime rates, divorce rates, mental illness, and welfare participation.

3.1.2 Community Surveys

A representative sample of each community will be surveyed by a standardized mail questionnaire, using appropriate follow-up techniques to ensure a 70% resonse rate. The respondent's overall satisfaction with the community will be determined by asking opinions about existing aspects of the built environment. This would include attitudes about such things as streets and roads, sidewalks, parks, and other man-made physical characteristics of the community. Cumulative attitudes will be determined by using a funnel-formed design questionnaire. This begins by addressing general issues, and becomes increasingly specific, ultimately asking an overall question addressing all aspects of the questionnaire in relation to community satisfaction.

Those items addressed in the questionnaire that have the greatest impact on community satisfaction will be determined and utilized in the development of the design model.

3.2 Design Model

A design model will be developed which embodies the amenities found to be most important through the survey. In addition, this design model will include design techniques for maximum cost effectiveness and energy efficiency.

3.2.1 Cost Effective Design Model

A design model will be developed for cost effectiveness in land development. Through the use of cluster developments and appropriate mixes of land use, costs for development, maintenance, and operation will be minimized in the model. The model will be developed in such a way that a developer can enter his site characteristics and get a reasonable estimate of his costs.

Figures 3-1 and 3-2 illustrate how by varying design approaches, developers can vary the need for certain improvements. For example, storm drainage, length of streets, or the need for severe grading are all dependent on the pattern, density, and orientation of the development. If by changing these factors the need for certain improvements is reduced or eliminated, the cost of development and maintenance is reduced.

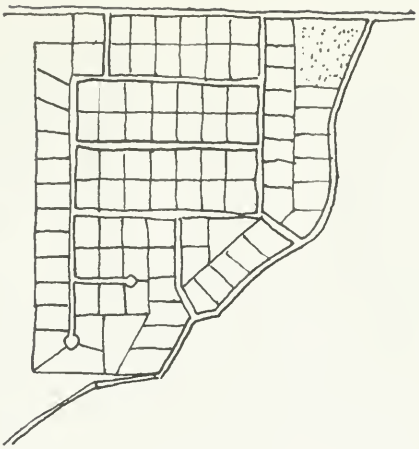

FIGURE 3-1: STANDARD DEVELOPMENT*

94 lots; 50,000 sq. ft.; 12,000 ft. road and utilities; storm drains required; small open space

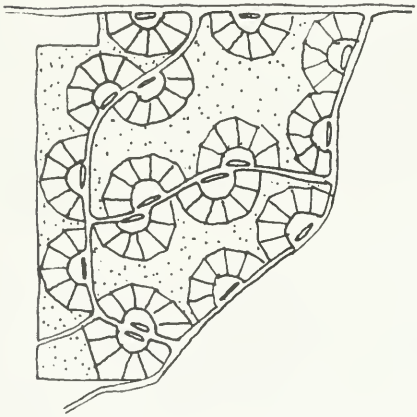

FIGURE 3-2: CLUSTER DEVELOPMENT*

96 lots; 30,000 sq. ft.; 6,000 ft. of road and utilities; storm drains may not be needed; large open space.

* Tunnard, Christopher and Boris Pushkarev, Man Made America: Chaos or Control? New Haven: Yale University Press, 1963.

For example, if there were a deep coulee across the site, the development pattern in Figure 3-1 would require filling the coulee and installing a storm sewer sufficiently large to accommodate its flow. In Figure 3-2, the open space could be laid out in such a way as to include the coulee, thus eliminating the need for a tremendous amount of earthwork and storm drainage. A further benefit might be the inclusion of natural landscape characteristics in the development, which otherwise would be destroyed during construction.

3.2.2 Energy Conservation Model

Certain practices can be implemented which yield energy conservation benefits. Cost estimates will be developed for these practices, both original construction and retrofit, so that a developer can judge whether or not investment in such practices will be in his interest or whether residents should perform these measures.

Energy conservation practices which will be examined include mixed use, clustering, the use of plant materials, solar considerations, and building site planning. Building design will not be considered.

3.2.3 Community Quality Model

Based on factors leading to high residential satisfaction, a model of community quality features will be developed which would enable a developer to determine which, if any, of these features should be included in his develoment.

3.3 Cost Comparison Models

To provide a full comparison, the design model will be compared to a conventional development model, requiring only manual operation, which meets but does not exceed subdivision law and which conforms to standard practices in most areas. This comparison will be on the basis of unit costs for construction of typically needed improvements for streets, utilities, and other needs. These will be derived from published sources, and will be considered to be equal for alternative construction technologies. This total cost will be dependent on total units with total benefits being dependent on the willingness of the market to pay for costs over the minimum.

Through the use of the comparison model, county planners will be able to see which land use schemes will have the lowest cost for maintenance and operation of needed services. Moreover, the consumer will see what portion of his investment goes toward energy conservation, community quality features, etc.

3.4 Development of User Packages

User packages of the model will be assembled to provide developers, county planners, and consumers with the tools to evaluate development options. These will be in the form of a user's manual and training slide show. Information developed throughout the study will be included with an explanation of concepts and conclusions. A working model will be included such that the user could enter information pertinent to specific areas, work the model manually, and derive conclusions on an optimum development strategy for a particular development.

4.0 MANAGEMENT

The proposed project will be managed through the Socioeconomic Division of MERDI's Technology Department and will follow standard administrative channels--that is, the principal investigator will report to the Division Manager who will represent the project to upper management. Internal project control and review is maintained through monthly project reviews by top level management. One very useful tool utilized by MERDI is the computerized management information system, which provides budget data on weekly, monthly, and project-to-date bases, inclusive of labor, travel, and materials.

4.1 Project Organization and Personnel

The Technology Department works together as a matrix organization to provide expertise in various disciplines required by a particular project. The Boomtown Community Design Project will be staffed by personnel from the Socioeconomics, Environmental, and Engineering Divisions and from Department Management, as shown in MERDI's organizational chart (Figure 4-1). Resumes for key personnel are presented in Appendix A.

This project relies heavily on the land use planner, who will be the principal investigator and will receive support as required from other personnel, as shown in Figure 4-2. John L. Barnett was chosen as principal investigator because of his experience and concern in the proposed work. Mr. Barnett, with nine years of professional experience,

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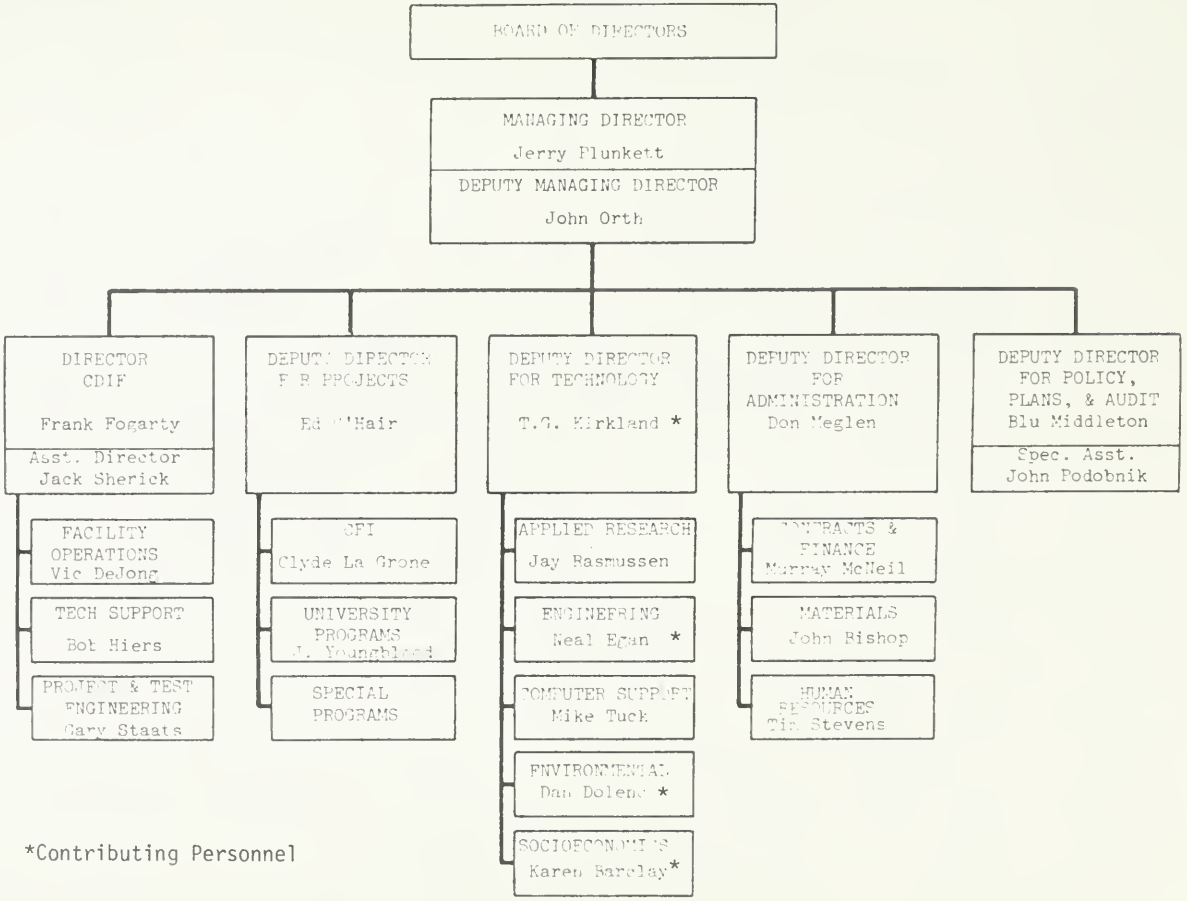
(MERDI)



*Contributing Personnel

FIGURE 4-1: MERDI ORGANIZATION CHART

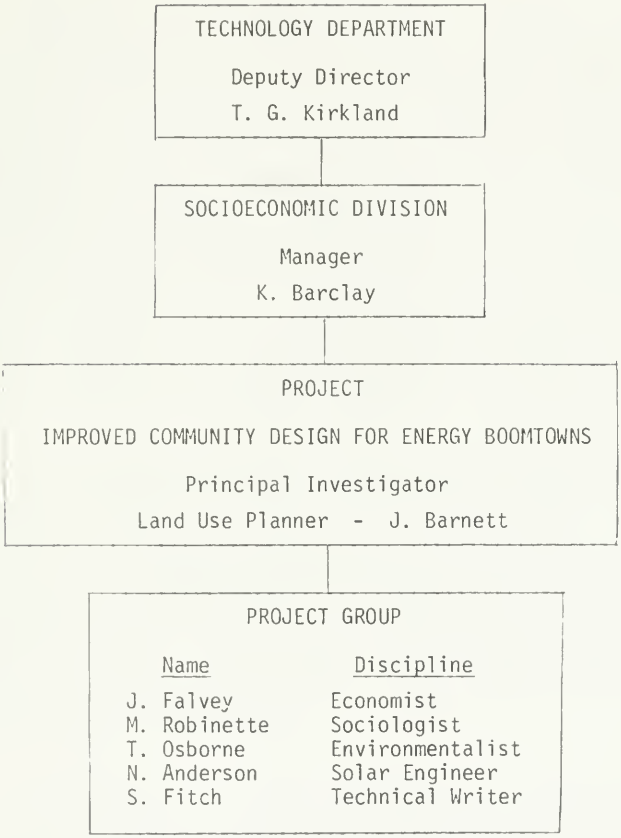


FIGURE 4-2: PROJECT ORGANIZATION

has worked on four urban and landuse planning programs in the Northeast and in Montana. He originated and developed the Energy Boomtown Community Planning Concept as presented in this proposal.

Previous to his employment at MERDI, Mr. Barnett worked as a planning coordinator for the Northern Cheyenne in eastern Montana. In that position he was responsible for developing a comprehensive planning program for the tribe, which dealt with modern problems of rapid energy development in the region coupled with a severely undeveloped economy. Mr. Barnett advised the tribal council specifically on matters relating to planning, energy impacts, and economic development and housing, including codes development and community facilities planning.

In a former position, he provided staff support to a city planning board for a rapidly growing city of 25,000 in Maine. This work included revising and administering land use ordinances to respond to short- and long-range needs. Mr. Barnett served in key positions for two redevelopment projects during this time--one for a neighborhood and the other for the downtown area.

Mr. Barnett will draw on other MERDI expertise as necessary to provide the most comprehensive community design possible. These other personnel include an economist, a sociologist, an environmental scientist, an engineer, and a technical writer.

Jim Falvey will provide economic analyses of community design. Dr. Falvey has 17 years experience in financial analyses, energy use economics, and socioeconomic impact of major facilities.

Maurice Robinette has designed several surveys intended to assess resident attitudes in areas considered for energy facility siting and in areas already impacted by energy-related development. These surveys were conducted in Montana for the U.S. Department of Energy, the Montana Power Company, and the U.S. Department of Defense. In addition, Mr. Robinette's earlier research was directed toward drug abuse, alcoholism, and juvenile delinquency, common problems in poorly planned boomtowns.

Tom Osborne is an environmental scientist trained in water resources, forestry, and natural resources management. He will be able to provide expertise in minimum destruction and maximum use of the natural environments of the community site. Mr. Osborne has participated in other land use planning studies, most notably in Colorado regarding energy-related growth.

Allan Miller is a professional engineer well versed in the design, specification, and application of community-sized energy production technologies. He will provide input on the integration of alternate energies into community design.

Sandra Fitch's experience in communications will be utilized to develop the User Package. Ms. Fitch has three years experience as a technical writer in environmental and socioeconomic projects, and

another year in media work. She also has an education background which includes the development of instructional materials.

4.2 Schedules, Deliverables, and Milestones

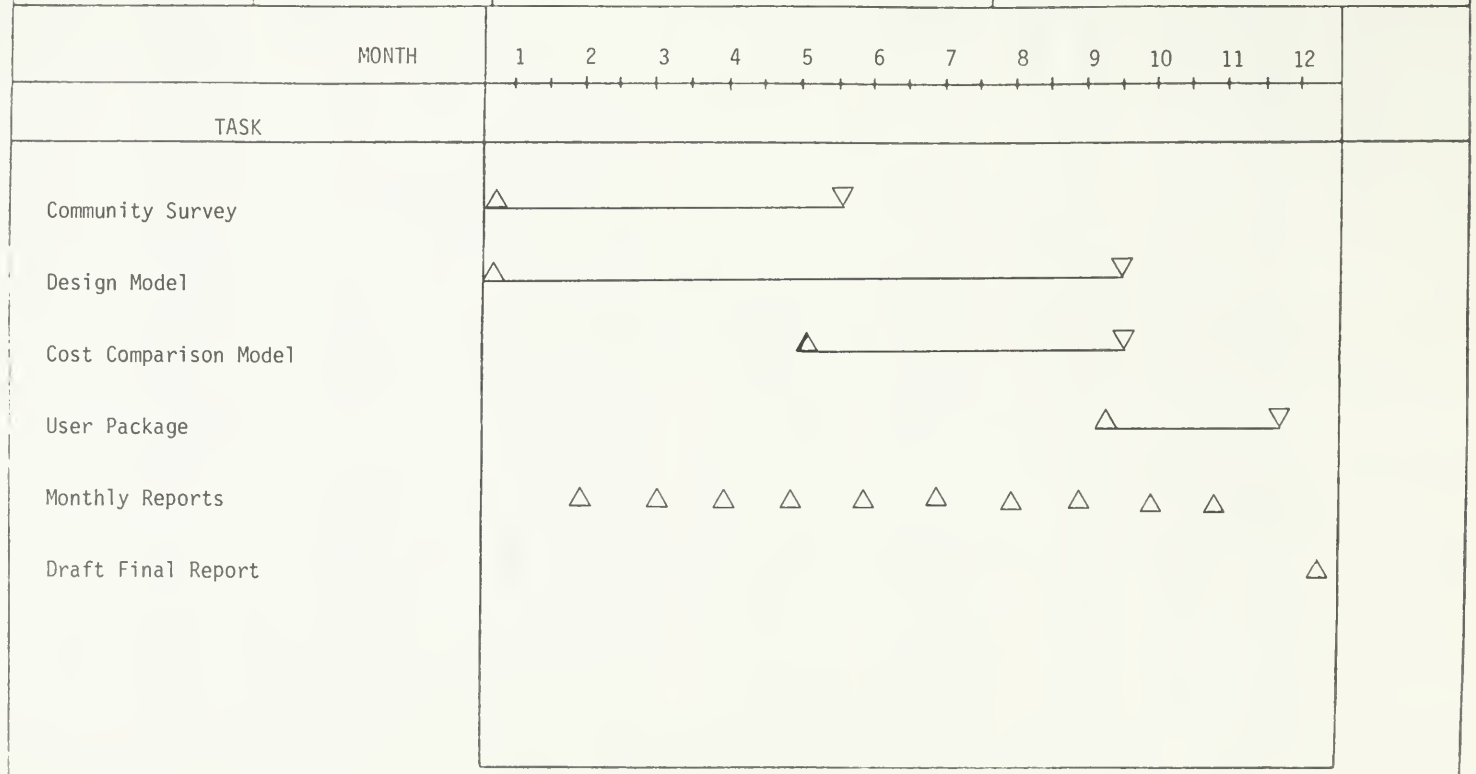
The proposed project will require 12 months to perform the work and approximately two manyears of effort. Figure 4-3 presents the project schedule arranged by major tasks.

Monthly reports will be provided for ten months, with the last two months of work incorporated into the final report. Each monthly will consist of a technical progress report and a financial statement.

The final report will document the completion of the project, significant areas of work, and task findings. Included with the final report will be a copy of the User Packages, slide show, and instructions for conducting a planner's workshop.

MONTHLY PROJECT STATUS REPORT

IMPROVED COMMUNITY DESIGN FOR ENERGY BOOMTOWNS



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5.0 BACKGROUND AND EXPERIENCE

The Montana Energy and MHD Research and Development Institute (MERDI) was organized in 1974 as a not-for-profit Montana corporation. The Institute's articles of incorporation specifically state MERDI's corporate intent:

> "To encourage, support, and perform energy and energy related research and development" and
>
> "To encourage, support and perform basic and applied research and development in other areas and fields in the public interest..."

This corporate purpose is reflected in MERDI's completed and continuing contracts with the Department of Energy (DOE), other government agencies, state agencies, and private industry.

MERDI's original and ongoing contract is to manage and operate a major development and hardware phase of the Department of Energy's national magnetohydrodynamic (MHD) program, the Component Development and Integration Facility (CDIF) in Butte, Montana.

Since its inception, MERDI has expanded its scope of activities in several areas:

- Siting studies for major power facilities;
- Environmental and socioeconomic impact analysis and verification;

- Development of renewable energy resources (wind, solar, biomass) for the state of Montana;
- Energy use modeling;
- Research of the treatment, storage, and disposal of hazardous wastes;
- Data base development;
- Computer modeling of pollutant dispersion and thermal/chemical reactions;
- Full service inventor assistance; and
- MHD materials research and development.

In six years, the Institute has grown from a handful of people with ideas to an organization with over 300 technical and resource personnel actively engaged in contract work totalling over $12 million yearly. The major corporate focus is on Montana and its unique needs and resources, and starting from this base MERDI has initiated expansion into national and international fields.

MERDI can combine corporate and personal skills and experience gained from other projects to field a knowledgeable team to perform the proposed work. Table 5-1 summarizes Institute experience for each task.

TABLE 5-1: MERDI EXPERIENCE FOR COMMUNITY DESIGN

PROPOSAL TASK	CORPORATE/ PERSONAL EXPERIENCE	CONTRACTING AGENCY	RELEVANCE TO PROPOSED WORK
Community Survey	Developed, administered, and analyzed results of a survey for residents of Butte-Silver Bow County to determine attitudes and change in attitudes toward a new technology, federal facility constructed near the county seat; another survey was of employees of facility (both native and in-migrated) to determine attitudes toward community;	U.S. Department of Energy (DOE)	Specific experience in survey design, administration, and analysis toward energy technologies and growth and/or change in community.
	Developed, administered, and analyzed results of a survey designed to discover attitudes of people living in or near several sites considered for a major electrical production facility, toward the utility company building the facility and the presence of such a facility near the community;	Montana Power Company	Specific exeprience in survey design, administration, and analysis toward energy facilities.
	Developed, administered, and analyzed results of a survey given to residents of Glasgow, Montana and surrounding area to solicit viewpoints on the reuse of an abandoned air force base nearby	Old West Regional Commission (OWRC), with funds from the U.S. Department of Defence (DOD)	Specific experience in survey design, administration, and analysis

TABLE 5-1 (Continued)

PROPOSAL TASK	CORPORATE/ PERSONAL EXPERIENCE	CONTRACTING AGENCY	RELEVANCE TO PROPOSED WORK
Design Model and Cost Comparison Model	Assessed visual impacts of a major, interstate pipeline on the environments of five candidate corridors in Montana; study defined potential aesthic and land use impacts of the pipeline	Montana Department of Natural Resources and Conservation (for incorporation into an Environmental Impact Statement on the Northern Tier Pipeline)	Direct experience in assessing the impact of the natural environment on human quality of life
	Constructed model of Montana energy use for 1975 through 2000	OWRC/DOD	Experience in cost and trade-off modeling
	Reviewed eight energy systems models to evaluate various modeling techniques and their applicability to electric utility planning	University of Oklahoma	Demonstrated analytical capability regarding modeling techniques for planning
	Eleven years combined professional experience in designing human environments for optimal use and satisfaction	Local governments	Direct experience by project personnel in planning and modeling community development
User Packages	Developed a Technology Department information slide presentation for presentation to potential contractors and to public groups	Internal management	Demonstrated ability to develop script and visuals for presentation to convey information
	Ten years combined professional teaching and materials development	Various state educational institutions, from junior high level through college	Demonstrated skills in developing and communicating educational materials

REFERENCES

1. J. Rose McKeever (editor), The Community Builders Handbook, Urban Land Institute, Washington, D.C., 1968.

2. Real Estate Research Corporation, The Costs of Sprawl: Environmental and Economic Costs of Alternative Residential Development Patterns at the Urban Fringe, U.S. Government Printing Office, Washington, D.C., 1974.

3. Tvenge - Larson, Energy Conservation Guidebook for Mercer County, North Dakota, Energy Development Board of Mercer County, Bismark, North Dakota, 1978.

APPENDIX

RESUMES

TERENCE G. KIRKLAND — Deputy Director for Technology

Experienced in the management of engineering research and development programs during 19 years in industry and 14 years in government.

EXPERIENCE

5/78 to present — Deputy Director for Technology for the Montana Energy and MHD Research and Development Institute in Butte, Montana. Responsible for administering and coordinating the activities of five divisions: Applied Research, Environmental, Socioeconomics, Engineering, and Computer Support. Responsible for the technical personnel and financial management of these divisions to accomplish the scientific and contractual tasks of the Institute. Served as Project Leader for a special study on the enhancement of the MHD Component Development and Integration facility from 50 MW_t to 100 MW_t and parameter analysis of a 300 MW_t to 700 MW_t MHD power plant.

3/77 to 4/78 — Assistant to the U.S. Army Chief of Engineers for Research and Development and Chief, Research and Development Office, Corps of Engineers, Washington, D.C. Exercised directive authority over the Commanders/Directors of the Corps-wide laboratories and technical supervision of the Corps of Engineer division and district laboratories to ensure optimum utilization of research and development resources under all applicable appropriations.

9/73 to 3/77 — Technical Director of the U.S. Army Mobility Equipment Research and Development Command (MERDC), Fort Belvoir, Virginia. Responsible for planning, organizing, directing, and controlling the technical programs of the Command and was the principal technical advisor for the Army Materiel Command in the research, development, and engineering of assigned items of equipment for combat use. Staff consisted of 1400 civilian and military personnel operating on a budget of $100-150 million.

5/77 to 9/73 — Chief, Countermine/Counter Intrusion Department, MERDC. Responsible for technical planning and direction of 178 scientists, technicians, and administrators in conduct of research, exploratory, advanced, and engineering development of military equipment for countering vehicle, land and personnel mines and battlefield, installation and unit intruders.

2/67 to 5/71 — Chief, Electrotechnology Laboratory, MERDC. Responsible for technical planning and direction of 200 scientists, engineers, technicians, and administrators in the conduct of research, applied research, advanced and engineering development, design, and evaluation of all mobile electrical generating equipment for the U. S. Army.

5/64 to 2/67 — Chief, Power Equipment Division, MERDC, Fort Belvoir, Virginia. Primary responsibility was to expand engineering activities in fuel cells and other advanced power plants. Supervised 70 to 80 scientists, engineers, and technicians doing research and advanced engineering development in those areas. Significant accomplishments during this time were 1) the development of the first self-sustaining and power-producing hydrocarbon-air fuel cell power plant prototype; 2) the

TERENCE G. KIRKLAND (Continued)

EXPERIENCE (Continued)

development of a practical hydrazine-air fuel cell power plant, culminating in the testing of twenty 300-watt hydrazine-air units in Southeast Asia in April 1969; and 3) the initiation of the turbo alternator approach for Army electrical power needs.

11/58 to 5/64 Manager, Applied Research and Manager of Engineering for all Government Research and Development Work, Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin. Supervised the activities of 20 engineers and 40 technicians in applied research relating to fuel cells and other advanced power plants, chemical processing, and heavy machinery design. Significant accomplishments during this time were 1) the first fuel cell system to survive zero gravity conditions for space exploration; 2) applied research on a gas-liquid-solid contactor-oxygenator for use in sewage disposal plants; and 3) a method for pelletizing hay.

EDUCATION

M.S. in chemical engineering, University of Wisconsin, Milwaukee, 1956.

B.S. in mining engineering, Montana College of Mineral Science and Technology, Butte, Montana, 1947.

AWARDS AND PROFESSIONAL MEMBERSHIPS

Professional Engineer, Wisconsin
American Institute of Chemical Engineers
American Institute of Mining and Metallurgical Engineers
Honorary Degree - Professional Engineer, Montana College of Mineral Science and Technology, 1974.

PUBLICATIONS

Several publications in the areas of mineral benefaction and electrochemical engineering.

KAREN L. BARCLAY — Manager, Socioeconomic Division

Experience includes socioeconomic analysis, economic feasibility studies, alternative energy development, and energy facility siting.

EXPERIENCE

1/78 to present	Manager of the Socioeconomic Division of the Montana Energy and MHD Research and Development Institute (MERDI) in Butte, Montana. Responsible for the management of various socio-economic programs including impact assessments, economic feasibility studies, energy facility siting studies, and economic development projects. Serves as Project manager for a geothermal utilization demonstration project involving environmental assessment, obtaining regulatory permits, well drilling, design and retrofit of a large hospital heating system and waste water disposal of spent geothermal fluid.
4/77 to 1/78	Special Assistant on Environmental Affairs for Corporate Development of MERDI. Responsibilities include acting as a liaison between MERDI and public interest groups; coordinating MERDI environmental activities; making recommendations to management on programs and projects of special environmetal concern; giving briefings, lectures, and seminars; contacting and consulting with government agencies, private firms, and academic institutions; synthesizing research; and preparing progress reports.
6/76 to 4/77	Environmental Economist with MERDI. Responsibilities included developing a regional dynamic energy system simulation model; developing a Montana comprehensive energy conservation plan, including renewable resource utilization; and conducting a detailed analysis of the environmental, social, and economic constraints involved in siting a major MHD test facility.
9/75 to 6/76	Junior High School Teacher with School District No. 10, Anaconda, Montana. Taught mathematics and social studies.
11/73 to 5/74	Teaching Assistant with the Mathematics Department of Carroll College, Helena, Montana. Assisted with freshman and sophomore advanced algebra and calculus classes.

EDUCATION

B.A. in mathematics (economics minor), Carroll College, Helena, Montana, 1975.

Advanced courses in environmental engineering, Montana College of Mineral Science and Technology, Butte, Montana.

JOHN L. BARNETT — Land Use and Town Planner II

Eight years experience in research, development, and implementation of city and town planning programs.

EXPERIENCE

3/80 to present — Land Use and Town Planner II for the Montana Energy and MHD Research and Development Institute in Butte, Montana. Responsible for land use and cultural environmental impact analysis for steam generation and power transmission facilities.

3/78 to 3/80 — Planning Coordinator for the Northern Cheyenne Research Project in Lame Deer, Montana. Responsible for development of comprehensive community development strategy for Northern Cheyenne Tribe, which is facing rapid energy development. Served as advisor to the Tribal Council on matters relating to community facilities planning, housing, and water supply planning.

1/75 to 3/78 — Planner and Landscape Architect for city of Auburn, Maine. Responsible for development and administration of ordinances regulating new development including zoning, subdivision, and planned unit development. Developed capital improvement programs for the city each year. Designed and directed construction of public works and streetscape improvements for two neighborhood revitalization projects. Coordinated transportation planning.

1/73 to 1/75 — Researcher, Department of Resource Economics, University of Vermont, Burlington. Conducted research into ways to improve municipal planning strategies.

6/72 to 1/75 — Landscape Architect for the Office of Terrence Boyle, Burlington Vermont. Responsible for landscape assessment for transmission line projects in Vermont and New Hampshire. Developed an evaluation structure for power facility location and demonstrated its applicability to Vermont.

EDUCATION

M.S. in Natural Resource Planning, University of Vermont, 1979.

B.S. in Landscape Architecture, Pennsylvania State University, 1972.

PUBLICATIONS

Design Program for Downtown Auburn, Auburn, Community Development Department, 1978.

Auburn's Comprehensive Plan Twenty Years Later, University of Vermont, Burlington. (Master's Thesis)

PUBLICATIONS (Continued

"Development and Underdevelopment: Some Rural Policy Implications," Hearings Before the Subcommittee on Family Farms, Rural Development and Special Studies of the Committee on Agriculture, House of Representatives Ninety Sixth Congress First Session on HR 3580, Washington: U.S. Government Printing Office, 1979.

Solving Indian Housing Problems, Northern Cheyenne Research Project, Paper 3, Lame Deer, Montana, 1979.

JAMES M. FALVEY — Socioeconomist IV

Ten years experience teaching economics with five years additional experience in business and industry. Primary experience is in industrial organization and environmental economics with emphasis on the economics of regulation.

EXPERIENCE

Summers 1978-79, 2/80 to present	Socioeconomist IV for the Montana Energy and MHD Research and Development Institute in Butte, Montana. Primary responsibilities include planning, scheduling, conducting, and coordinating projects including siting studies and socioeconomics impact studies. Serves in an advisory capacity on technical problems.
1975 to 5/78	Assistant Professor of Economics, Hamilton College, Clinton, New York. Duties included teaching courses in money and banking, corporation finance, and industrial organization with emphasis on regulatory economics.
1973 to 1975	Chief, Cultural and Economic Sciences Bureau, Energy and Planning Division, Montana Department of Natural Resources and Conservation, Helena. Reviewed and wrote socioeconomic sections of environmental impact statements. Performed corridor selection studies for transmission lines.
1967 to 1973	Teaching and Research Assistant for the departments of Economics and Electrical Engineering and the school of Labor and Industrial Relations, Michigan State University, East Lansing, Michigan.
1963 to 1966	Financial Analyst, Hartford Electric Light Company, Weathersfield, Connecticut. Worked on actuarial analysis of plant and equipment to update plant life estimates used in company's depreciation accounting.

EDUCATION

Ph.D in economics, Michigan State University, East Lansing, Michigan, 1973.

B.A. in economics, Williams College, Williamstown, Massachusetts, 1963.

PUBLICATIONS

"The Need for the Proposed Facility," Environmental Impact Statement on Colstrip Electric Generating Units 3 and 4, 500 Kilovolt Transmission Lines and Associated Facilities, Volume 2, Chapter 4, Montana Department of Natural Resources and Conservation, 1974.

PUBLICATIONS (Continued)

"Alternatives," Environmental Impact Statement on Colstrip Electric Generating Units 3 and 4, 500 Kilovolt Transmission Lines and Associated Facilities, Volume 2, Chapter 6, Montana Department of Natural Resources and Conservation, 1974.

Herman E. Koenig, William E. Cooper, and James Falvey, "Engineering for Ecological, Sociological, and Economic Compatibility," IEEE Transactions on Systems, Man, and Cybernetics, Volume SMC-2, No. 3, July 1972.

Herman E. Koenig, William E. Cooper, and James Falvey, "Industrialized Ecosystem Design and Management," Annual Report, National Science Foundation, NSF G1-20, Michigan State University, July 1, 1971.

"Problems of Regulation," Proceedings of the 12th Conference on Value Inquiry, State University College of Arts and Science, Genesseo, New York, May 1978.

MAURICE ROBINETTE — Socioeconomist II

Experience in research methodology, data analysis, and questionnaire design.

EXPERIENCE

8/78 to present	Socioeconomist II for the Montana Energy and MHD Research and Development Institute in Butte, Montana. Primary responsibilities include development of methodological procedures and data analysis for sociological and economic research. These include various public opinion and attitude surveys including a Social Impact Assessment of the potential reuse of Glasgow Air Force Base, a site selection survey for a major power plant (state-wide) and a community satisfaction survey of Butte, Montana.
8/77 to 7/78	Research Analyst for the Girls Center, Incorporated in Lewiston, Idaho. Prepared and conducted recreation and delinquency (including drug usage) assessments for school-age girls in Lewiston, Idaho and Clarkston, Washington in a project funded by the Deartment of Health, Education and Welfare, Title VI Special Projects Grant.
10/76 to 4/77	Research Analyst for the Department of Agricutural Economics at the University of Idaho in Moscow, Idaho. Conducted questionnaires for an erosion attitude survey and analyzed a survey on the role of government in Idaho. Prepared a methodology for a state-wide study on attitudes toward welfare and food stamps.
4/76 to 10/76	Social Caseworker II for the Child Development Center, Department of Health and Welfare in Lewiston, Idaho. Duties included data analysis of client characteristics and design of a computerized learning assessment program.
9/73 to 6/75	Research Analyst for Valley Behavioral Research in Clarkston, Washington. Compiled and analyzed state substance abuse plan. Designed a video tape treatment technique for alcoholic rehabilitation. Analyzed Region II (Idaho) child abuse data.

EDUCATION

M.A. in sociology, University of Idaho, Moscow, Idaho.

B.A. in sociology, Eastern Washington University, Cheney, Washington.

THESIS

Affects of Religious Affiliation on Innovation: Acceptance of Irrigation Innovations by Rural Mormons and Non-Mormons, University of Idaho G raduate Thesis (unpublished).

C. NELS ANDERSON Engineer II

Four years research in solar energy use and design. Expertise in mechanical engineering.

EXPERIENCE

6/80 to present — Engineer for the Montana Energy and MHD Research and Development Institute (MERDI) in Butte, Montana. Provides design expertise in solar energy developments and reviews instrumentation and control design adequacy. Works on various mechanical and construction design in support of the Department of Energy's magento-hydrodynamic Component Development and Integration Facility.

6/78 to 6/80 — Research Engineer performing privately contracted research through the Mineral Research Center and Montana Tech, Butte. Three overlapping grants ($15,000, $16,000, $30,800) from the Montana Department of Natural Resources and Conservation to study solar energy usage in residential heating, measurements of thermal performance, solar insolation available, and testing durability and thermal efficiency of flat plate solar collectors and associated equipment. Contracted to private manufacturers for testing of collectors.

3/75 to 6/76 — Project Engineer for the Montana Highway Department, Butte Division, on construction of interstate highways. Surveyed layout for contracted construction, acted as liason with contracting firms, and performed required field engineering.

6/73 to 3/75 — Project and Planning Engineer for the Anaconda Company, Butte. Performed construction engineering and supervision on projects within the Berkeley Pit, the Clyde E. Weed Concentrator, and the Crusher Complex. Specific duties included construction of a Bucryus-Erie 480W walking dragline; tailings pumping systems maintenance and design modifications; parnell ventilation shaft design and construction; construction of one and half million gallon tank farm for diesel fuel storage; design of metallurgical laboratory in Weed Concentrator; survey and mine design. Gained familiarity with plat, mining patent, and engineering surveys. Designed leach screening plant, including conveyor systems, vibrating grizzly, and shaker screen for ore separation. Designed gland seal pumping system.

EDUCATION

M.S. in engineering science, Montana College of Mineral Science and Technology, Butte, 1978.

Graduate studies in Engineering Science, Montana Tech. Research work and thesis work involved solar energy usage in residential heating. Program of studies concentrated in thermodynamics, heat transfer, and process control and instrumentation.

EDUCATION (Continued)

B.S. in engineering science, Montana College of Mineral Science and Technology, Butte, 1972.

Graduate studies in Mechanical Engineering, Washington State University, Weyerhaeuser Corporation Fellowship. Research in the Heat Transfer Effects in Particle Wood Drying involving the conductive and convective mechanism of heat transport in Heil-type dryers that reduce the moisture content of particle wood prior to resin bonding.

PUBLICATIONS

"Comfort Heating with Solar Energy", Co-author with Charles L. Herndon, Montana Department of Natural REsources and Montana Bureau of Mines, 1980.

"Feasibility of Residential Heating Using Solar Energy", MS Engineering Science Thesis, Montana Tech, 1978.

"Heat Transfer, Effects in Particle Wood Drying", Research Assistant, ME Department, Washington State University, 1976.

"Control Circuits for Semi-Automatic Manual Transmissions", Montana Tech Instrumentation and Control Project, 1972.

"Air Pollution Characteristics of Internal Combustion Engines", Montana Tech RD&D Engineering Science Project, 1972.

PROFESSIONAL MEMBERSHIPS

American Society of Mechanical Engineers
International Solar Energy Society
Montana Society Professional Engineers

SANDRA S. FITCH — Document Control Specialist

Four years experience in various types of communications, including writing, editing, media work, and public speaking.

EXPERIENCE

1/80 to present — Document Control Specialist for the Technology Department of the Montana Energy and MHD Research and Development Institute (MERDI) in Butte, Montana. Determines and maintains schedules for the preparation and production of Department deliverables and supervises other Department writers. Coordinates proposal efforts to produce complete and unified documents. Continues responsibilities as a technical writer on specified projects.

6/77 to 1/80 — Technical Writer for MERDI's Technology Department. Responsible for editing and proofing technical reports and proposals. Specific assignments include writing sections of monthly, quarterly, and annual progress reports, special reports, and proposals. Duties also have included writing feature articles for publications and newspapers, and writing pamphlets and information handouts.

9/76 to 6/77 — Part-time employee for the Montana College of Mineral Science and Technology Information Office, Butte. Performed clerical duties and wrote news releases. Duties also included maintaining a news clipping file and general public relations work.

9/74 to 6/76 — English Teacher for the Grants Community School System, Grants, New Mexico. Responsibilities included teaching approximately 180 students in the areas of English grammar, literature, and remedial reading. During this time, devised a programmed grammar unit and a creative writing unit for junior high school students.

EDUCATION

B.A. in English, Indiana University, Bloomington, 1974.

18 weeks of student teaching, Many Farms School, Many Farms, Arizona (Navajo Reservation).

Attended Bid and Proposal Process Seminar, Communications Management Associates, San Jose, California, November 1979.

Attended Media Relations Workshop, Montana Chapter of Women in Broadcasting, Helena, Montana, April 1978.

Over 100 hours completed on a B.S. in technical communications, Montana College of Mineral Science and Technology, Butte.

PROFESSIONAL ORGANIZATIONS

Society of Technical Communicators
American Association of University Women

SANDRA S. FITCH (Continued)

PUBLICATIONS

"MHD-Developing Technology to Meet the Energy Crisis," Intellect Magazine, Volume 106, No. 2395, April 1978.

RELATED EXPERIENCE

Prepared and presented in-house seminar on proposal preparation.

Served as president and speaker for the Women's Educational Board, Montana College of Mineral Science and Technology.

THOMAS J. OSBORNE — Hydrologist/Scientist II

Six years experience in hydrologic systems analyses and water quality investigations, including regional watershed modeling, surface and groundwater flow studies and field measurements, and hydrological analysis of alluvial valleys.

EXPERIENCE

2/80 to present	Hydrologist for the Montana Energy and MHD Research and Development Institute, Butte, Montana. Responsibilities include direction of field data collection, data compilation and analysis, and the design and implementation of hydrologic investigations.
6/76 to 1/80	Hydrologist and Principal Investigator for the Northern Cheyenne Research Project, Lame Deer, Montana. Responsible for the collection of field samples, data analysis, and report preparation for a variety of hydrologic investigations. Also acted as contract or grant administrator on a variety of Environmental Protection Agency- and Bureau of Indian Affairs-funded projects.
6/75 to 5/76	County Resource Agent for the University of Wisconsin Extension Unit, Eagle River, Wisconsin. Acted as a county-wide advisor on environmentally related matters.
5/74 to 5/75	Energy Research Analyst for the Colorado Rural Legal Services, Grand Junction, Colorado.

EDUCATION

M.S. in water resources management, University of Wisconsin, Madison, 1974.

B.S. in forestry and natural resources management, University of Wisconsin, Stevens Point, 1970.

PUBLICATIONS

Numerous publications on the effects of land use upon the hydrologic system.

PROFESSIONAL MEMBERSHIPS

American Geophysical Union
Board of Directors, Yellowstone-Tongue Areawide Planning Organization